

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants : Takeshi Oohashi et al.
Serial No. : 09/926,033
Filed : November 7, 2001 (PCT filing date: March 2,
2000)
For : PHOTSENSITIVE RESIN COMPOSITION,
PHOTSENSITIVE ELEMENT USING THE SAME, PROCESS
FOR PRODUCING RESIST PATTERN AND PROCESS FOR
PRODUCING PRINTED WIRING BOARD
Art Unit & Examiner : Art Unit 1752
Examiner Thornton, Yvette C

DECLARATION UNDER 37 CFR 1.132

Assistant commissioner for Patents
Washington, D.C. 20231

Sir:

I, Takeshi Oohashi, Japanese citizen, residing at c/o
Hitachi Chemical Company, Ltd., Yamazaki Works, 4-13-1,
Higashicho, Hitachi-shi, Ibaraki 317-8555 Japan, declare and
state that;

1. I have a degree in engineering, which was conferred upon
me by Hokkaido University, Graduate school of Engineering in
Sapporo-shi, Hokkaido, Japan, in March, 1997.
2. I and have been employed by Hitachi Chemical Co., Ltd.
since April, 1997, and I have had a total of seven years of
work and research experience in the development of
photosensitive film.
3. I am one of the named inventors of the above-identified
application and am familiar with the subject matter disclosed
in said application.

4. I conducted experiments (Experiments 7-11) to show that the claimed invention is not obvious over Lipson et al. in view of Ishikawa, or over Lipson in view of Ishikawa and Kawashima.

The preparation of a solution of a photosensitive resin composition and a photosensitive element and the evaluation of adhesion and scum were repeated in the same manner as in Example 1 of the applicant's specification except that the component was changed as shown in the attached table.

Experiments 7 and 8 are for copying Example V (Formula VA) of Lipson et al. In these experiments, phenoxyethoxyethyl acrylate (m=2) and phenoxytriethoxyethyl acrylate (m=4) were used in place of phenoxydiethoxyethyl acrylate (m=3) used by Lipson et al. since phenoxydiethoxyethyl acrylate (m=3) was not available.

Experiment 9 is the same as Example 1 of the specification except that another halogenated 2,4,5-triarylimidazole dimer is used as a component (B).

Experiment 10 is the same as Example 1 of the specification except that diethylene glycol diacrylate was used in place of 2,2-bis[4-(methacryloxy)phenyl]propane as a component (C).

Experiment 11 is the same as Example 1 of the specification except that a non-halogenated 2,4,5-triarylimidazole dimer is used as a component (B).

By using the components of experiments 7-11, the preparation of a solution of a photosensitive resin composition and a photosensitive element and the evaluation of adhesion and scum were repeated in the same manner as in Example 1 of the applicant's specification.

The results of the experiments are given in the following table.

The results of the evaluations in the table are as follows:

Adhesion: the width of the narrowest fine line remained adhering after developing.

Low tendency to scum:

No: Scum did not occur.

Yes: Scum occurred.

4. As to rejection of claim 1, 3-13, 15-18, 19-23 under 35 U.S.C. 103 as being unpatentable over Lipson et al. (U.S. Patent No. 4,539,236) in view of Ishikawa et al. (JP 10-020491 A);

Lipson et al. do not teach using the specific photopolymerization initiator (B) (a 2,4,5-triarylimidazole dimer) and the photo-polymerizable compound (C), (C') or (C'') that are contained in the claimed photosensitive resin composition. In the components (C), (C') and (C''), m, which is the repeating number of alkylenoxy or ethylenoxy group, is an integer of 6 to 18 or 6 to 20. Lipson et al. disclose acrylates wherein the repeating number of alkylenoxy group is 1-12. However, they teach the repeating number is most preferably 2 or 3 (column 4, lines 25-26), and in working examples, they do not use other acrylates than acrylates wherein the repeating number of alkylenoxy group is 3 or 4, and do not present any data showing the effects of acrylates wherein the repeating number of alkylenoxy group is 6 or more. That is, the practical teaching of Lipson et al. is limited to photosensitive resin compositions containing acrylates wherein the repeating number of alkylenoxy group is 4 or less. Ishikawa discloses acrylates wherein the repeating number of alkylenoxy group is 3-20. However, in working examples, Ishikawa does not use other acrylates than an acrylate wherein the repeating number of alkylenoxy group is 4, and does not present any data showing the effects of acrylates wherein the repeating number of alkylenoxy group is 6 or more. That is, the practical teaching of Ishikawa is limited to photosensitive resin compositions containing

acrylates wherein the repeating number of alkylenoxy group is 4.

Ishikawa et al. disclose 2,4,5-triarylimidazole dimers (component (B) of the claimed invention) as photopolymerization initiators. However, Ishikawa et al. do not teach or suggest to use the 2,4,5-triarylimidazole dimers in combination of the specific components (A) and (C) used in the claimed composition. Furthermore, Ishikawa et al. do not use them in working examples, and do not teach any effect thereof as compared with other photopolymerization initiators, such as those used by Lipson et al.

Comparison of experiments 7 and 8 with Example 1 of the specification and experiments 9-11 shows that the claimed compositions are superior in adhesion as compared with the composition of Ishikawa Example V (copied by experiments 7 and 8) wherein the specific components (B) and (C) of the claimed invention are not used. Also, the results of these experiments and the experiments presented in the previous declaration show that the specific combination of the claimed components (A), (B) and (C) is necessary to obtain a photosensitive resin composition excelling both in adhesion and prevention of scum. None of references cited teach or suggest using the specific components (A), (B) and (C) in combination, and the effects of improving adhesion and preventing scum are significant and not expectable from the teaching of the cited references. The claimed invention, therefore, would not have been obvious from the teaching of Lipson et al. in view of Hashimoto.

5. As to rejection of claims 24-26 under 35 U.S.C. 103(a) as being unpatentable over Lipson et al. in view of Ishikawa as applied to claims 1, 3-13, 15-18 and 20-23, and further in view of Kawashima:

First, there is no substantial teaching of the specific component (C) used in the claimed invention in Lipson et al

and Ishikawa. Second, Lipson et al. do not teach the use of the component (B) (2,4,5-triarylimidazole dimer) used in the claimed composition, and in Ishikawa, there is no teaching or suggestion that motivates one of ordinary skill in the art to use the taught 2,4,5-triarylimidazole dimer in the composition of Lipson et al.

Third, as the Examiner says, Lipson et al. teach the use of diethyleneglycol diacrylate and bis-acrylates and methacrylates of polyethylene and polypropylene glycols such as tripropylene glycol diacrylate, and Kawashima teaches the use of a (meth)acrylic monomer, such as diethylene glycol di(meth)acrylate, tripropylene glycol di(meth)acrylate, 2,2-bis[4-(acryloxypolyethoxy)phenyl]propane and 2,2-bis[4-(methacryloxypolyethoxy)phenyl]propane. According to the Examiner's position, Kawashima serves to equate 2,2-bis[4-(acryloxypolyethoxy)phenyl]propane, 2,2-bis[4-(methacryloxypolyethoxy)phenyl]propane, diethylene glycol di(meth)acrylate and tripropylene glycol di(meth)acrylate in the art, and one of ordinary skill in the art would have been motivated to substitute 2,2-bis[4-(acryloxypolyethoxy)phenyl]propane and 2,2-bis[4-(methacryloxypolyethoxy)phenyl]propane for the taught diethylene glycol diacrylate and tripropylene glycol diacrylate of Lipson and expect reasonably similar results. However, Kawashima does not teach or suggest the use of 2,2-bis[4-(acryloxypolyethoxy)phenyl]propane or 2,2-bis[4-(methacryloxypolyethoxy)phenyl]propane in combination with the specific components (B) and (C) of the claimed composition. Kawashima teaches neither of the component (B) nor the component (C) of the claimed composition. One of ordinary skill in the art would not have expect any results of the use of 2,2-bis[4-(acryloxypolyethoxy)phenyl]propane of 2,2-bis[4-(methacryloxypolyethoxy)phenyl]propane together with other components that are not taught or suggested by Kawashima. As explained above and in the previous

declaration, the properties of photosensitive resin compositions are influenced by the selection of the combination of components contained therein. Furthermore, the results are not similar. As shown by comparison of Example 1 of the applicant's specification and experiment 10 in this declaration, the composition containing 2,2-bis[4-(methacryloxypolyethoxy)phenyl]propane is improved in adhesion as compared with the composition containing diethylene glycol diacrylate. This effect is not expectable from the teaching of Kawashima. Therefore, the claimed photosensitive resin composition would not have been obvious from the teaching of Lipson et al. in view of Ishikawa, further in view of Kawashima.

	Components	Ex.	Experiments				
		1	7	8	9	10	11
(A)	Binder polymer	60g *1	60g *2	60g *2	60g *1	60g *1	60g *1
(B)	2-(o-chlorophenyl)-4,5-diphenylimidazole dimer	3.0g	-	-	-	3.0g	-
	2-(o,p-dichlorophenyl)-4,5-diphenylimidazole dimer *3	-	-	-	3.0g	-	-
	Benzoic acid, 2,2'-(4,4',5,5'-tetraphenyl [1,1'-bi-1H-imidazole]2,2'-diyl)bis-dimethyl ester *4	-	-	-	-	-	3.0g
	2,2-dimethoxy-2-phenylacetophenone	-	6g	6g	-	-	-
	N,N'-tetraethyl-4,4'-diaminobenzophenone	0.2g	-	-	0.2g	0.2g	0.2g
(C)	Nonylphenoxyhexaethylenoxy acrylate (m=6)	10g	-	-	10g	10g	10g
	Phenoxytetraethylenoxy acrylate (m=4)	-	15g	-	-	-	-
	Phenoxydiethylenoxy acrylate (m=2)	-	-	15g	-	-	-
	EO,PO-modified urethane dimethacrylate	10g	-	-	10g	10g	10g
	2,2-bis[4-(methacryloxypentaethoxy)phenyl]propane	20g	-	-	20g	-	20g
	Diethylene glycol diacrylate	-	-	-	-	20g	-
	Trimethylolpropane triacrylate	-	20g	20g	-	-	-
Others	Leuco crystal violet	0.5g	0.5g	0.5g	0.5g	0.5g	0.5g
	2,2'-methylene-bis(4-ethyl-6-tert-butylphenol)	-	0.2g	0.2g	-	-	-
	Benzotriazole	-	0.15g	0.15g	-	-	-
	Malachite green	0.05g	0.05g	0.05g	0.05g	0.05g	0.05g
Solvent	Methyl ethyl ketone	-	60g	60g	-	-	-
	Acetone	10.0g	-	-	10.0g	10.0g	10.0g
	Toluene	10.0g	-	-	10.0g	10.0g	10.0g
	Methanol	3.0g	-	-	3.0g	3.0g	3.0g
	N,N-dimethylformamide	3.0g	-	-	3.0g	3.0g	3.0g
Adhesion (μ m)		20	32	32	20	22	20
Scum		No	No	No	No	No	No

*1: Copolymer of methacrylic acid/styrene/methyl methacrylate = 20wt%/20wt%/60wt%

Mw* 60,000, Acid value: 130 mgKOH/g

*2: Copolymer of methacrylic acid/styrene/methyl methacrylate/butyl acrylate = 30wt%/23wt%/35wt%/11wt%

*3: Hodogawa Chemical Co., Ltd.

*4: Hampford Research Inc.

6. The undersigned DECLARANT declares further the all statements made herein of his/her own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that the willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Executed this 21st day of February, 2005.

Takeshi Ohashi

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